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The importance of Lotmanian semiotics to sign theory and the cognitive neurosciences

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Abstract. The following paper is based on a presentation given as the Juri Lotman Lecture at the University of Tartu conference "Creative Continuity: 50 years of *Sign Systems Studies*", on December 5th, 2014. The focus of the current analysis is to bring to light important new directions in cognitive neuroscience and cognitive neurolinguistics and how Lotman's work contributes to deepening our understanding of the complex relationship of language(s) and brain(s) and the ever present dynamic cultural context.

Keywords: autocommunication, collective memory, future of semiotics, Lev Vygotsky

Lotman's contributions to semiotic theory, anthroposemiotics, the study of artistic texts and defining the relationship between language and culture represent some of the most powerful works produced within the Tartu–Moscow School of Semiotics. Key fundamental principles of Lotman's theoretical work include a fully developed dynamic and interactive modelling of the semiosphere, the importance of acknowledging multiple (never singular) languages as minimums of semiotic meaning-generation, *culture-text*-level generation of collective memory, and the ever-present tension in communication acts. These principles are essential in deepening our understanding of the neurological interface of language, memory and culture. This essay will explore the importance of Lotmanian paradigms in providing a basis for understanding variation at the neurological level for higher cognitive functions like language.

By way of introduction, I would like to draw the reader's attention to specific works by Lotman that are integral to research in the semiotics of culture, the cognitive sciences and cognitive neurolinguistic. These works include book-length publications like *Culture and Explosion, Universe of the Mind, Semiosfera, Besedy o russkoj kul'ture,* as well as numerous articles devoted to particular authors or cultural phenomena. Perhaps the best way to focus attention is to provide a series of quotes that reveal the depth of Lotman's contributions.

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One of Lotman's most powerful articles is "Text in a text", published in two redactions in 1992. This work provides a brilliant basis for articulating the dynamic process of the interaction of texts – not only literary texts, but the texts resulting from actual speech acts (by both monolingual and multilingual speakers/hearers) and how new meanings are generated in these interactions. Below is but one example of the important dynamic of the interaction of texts: Lotman 1992a: 105, 110):

> *[...] любое пересечение систем резко увеличивает непредсказуемость дальнейшего движения. Случай, когда внешнее вторжение приводит к победе одной из столкнувшихся систем и подавлению другой, характеризует далеко не все события. Достаточно часто столкновение порождает нечто третье, принципиально новое, которое не является очевидным, логически предсказуемым последствием ни одной из столкнувшихся систем.*
> *Вторжение «обломка» текста на чужом языке может играть роль генератора новых смыслов. Это подчеркивается, например, возможностью введения говорений на «никаком» языке, которые, однако, оказываются чрезвычайно насыщенными смыслом.* (Lotman 1992a: 105, 110)

> […] any intersection of systems can greatly increase the unpredictability of further development. The case where external intrusion allows one of the interacting systems to triumph over the other is not necessarily the characteristic outcome of such interactions. It is often the case that the collision gives rise to something else, something principally new, which is not obvious or a logical predicated outcome of either of the colliding systems.
> The intrusion of a "fragment" of a text in another language can act as a generator of new meanings. This point is emphasised, for example, by the possibility of the introduction of discourses in a non-existent language, which, nevertheless, turns out to be extraordinarily saturated with meaning. (My translation, E. A.)

Lotman's later work, *Culture and Explosion*, focuses on the important interaction of continuous and discontinuous cultural processes and how they combine to create dynamic and polysemic meanings at multiple levels. This includes the interaction of different perspectives, orientations in time and space, and translatability:

> *И постепенные, и взрывные процессы в синхронно работающей структуре выполняют важные функции: одни обеспечивают новаторство, другие – преемственность. […] Пересечение разных структурных организации становится источником динамики. […] Прошедшее дается в двух его проявлениях: внутренне – непосредственная память текста, воплощенная в его внутренней структуре, ее неизбежной противоречивости, имманентной борьбе со своим внутренним синхронизмом, а внешне – как соотношение с внетекстовой памятью. Мысленно поместив себя в то «настоящее время», которое реализовано в тексте [...], зритель как бы обращает свой взор в*

> *прошлое, которое сходится как конус, упирающийся вершиной в настоящее время. Обращаясь в будущее, аудитория погружается в пучок возможностей, еще не совершивших своего потенциального выбора. Неизвестность будущего позволяет приписывать значимость всему.* (Lotman 1992a: 26–27)

> *[...] чем труднее и неадекватнее перевод одной непересекающейся части пространства на язык другой, тем более ценным в информационном и социальном отношениях становится факт этого парадоксального общения. Можно сказать, что перевод непереводимого оказывается носителем информации высокой ценности.* (Lotman 1992a: 15)

> Both gradual and explosive processes in a synchronized working structure fulfill important functions: some guarantee novelty, others succession. The intersection of different structural organizations becomes the source of the dynamic […]. The past is given in two manifestations: internal – the direct memory of the text as embodied by its internal structure, its unavoidable contradictions, its immanent battle with its own internal synchronism, and external – as it correlates with extra-textual memory. Placing oneself into the present, which is realized in the text…, the viewer actually fixes his gaze into the past, which converges like a cone with its end-point in the present. Looking into the future, the participant becomes inundated by a spectrum of possibilities that have not yet made their potential choice. The unknown nature of the future allows anything to be potentially meaningful… (translated in Andrews 2003: 38, 39)

> […] The more difficult the translation of one non-intersecting space into another language, the higher the value of this paradoxical interaction in terms of its informative and social nature. One might say that the translation of the untranslatable turns out to be the vehicle for highly valuable information […]. (translated in Andrews 2003: 49).

The ideological fundamentals of *Culture and Explosion* imply Lotman's concept of the *semiosphere,* originally introduced in 1984. The *semiosphere* is the prerequisite space that guarantees the potential for semiosis, which is in essence the generation of meanings. In Lotman's own words, the semiosphere is "the semiotic space necessary for the existence and functioning of languages, not the sum total of different languages; in a sense the semiosphere has a prior existence and is in constant interaction with languages" (Lotman 1990: 123), "a generator of information" (Lotman 1990: 127). Semiospheric space is the precursor to and the result of cultural development (Lotman 1990: 125). Lotman outlines the fundamental organizing principles of the semiosphere in *Universe of the Mind* to be *heterogeneity* of the space, *asymmetry* of internal structures, *binariness* of internal and external spaces, *boundaries* defined as bilingual filters that allow for the exchange of semiotic processes, and the "development of a metalanguage" as the final act of the system's structural organization (Lotman 1992a: 124–140). Of

these five points, only one is discussed in *Culture and Explosion* – in fact, the term *semiosphere* only appears in *Culture and Explosion* on two occasions. Specifically, in the chapter entitled "The logic of explosion" Lotman focuses on the notion of heterogeneity as a characteristic of not only spatial differentiation, but even different rates of change between and within individual subspaces of the semiosphere (Lotman 1992a: 177):

> *Семиологическое пространство заполнено свободно передвигающимися обломками различных структур, которые, однако, устойчиво хранят в себе память о целом и, попадая в чужие пространства, могут вдруг бурно реставрироваться. […] Полностью стабильных, не изменяющихся семиотических структур, видимо, не существует вообще.*
>
> Semiological space is filled with the freely moving fragments of a variety of structures which, however, store stably within themselves a memory of the whole which, falling into a strange environment, can suddenly and vigorously restore themselves. […] Completely stable invariant semiotic structures apparently do not exist at all. (Lotman 2009: 114)

Lotman's reiteration of the importance of a complex *dynamic* within and around the semiosphere speaks to its critical role in capturing the essence of its explanatory power as a modelling system. The fundamental tenet of Lotman's approach to semiotics is the importance of semiotics as a dynamic process of *semiosis,* which is a system-level phenomenon engaging multiple sign complexes that are given simultaneously across spatio-temporal boundaries. As Lotman's work is contextualized into the broader fields of structuralist and non-structuralist semiotic paradigms (e.g. comparisons with the works of Saussure, Hjelmslev, Peirce, Jakobson and others) and more recently the cognitive sciences, it is crucial to understand Lotman's decision to target his theoretical models at the system level, and not at the individual sign level. This fact may explain, for example, why Lotman does not devote more works to explications of sign types using iconicity, indexicality and symbolic distinctions.

Lotman's work has often been read through the prism of other semiotic contributors of the 20th century, resulting in what often appears to be an attempt to position Lotman as more of a borrower of ideas than an innovator of ideas. While it is certainly true that Lotman was deeply influenced by his own professors and some of the most outstanding intellectuals of his day, Lotman's work is unique in its achievement of a broadly-based *metalanguage* for the *modelling* of cultures, *a system of systems*. (Lotman's interest in modelling systems involves two major trajectories: (1) the creation of metasemiotics, which focuses more on modelling the text than the text itself, and (2) the specific semiotic functioning of actual texts (1992a: 129). It is the second trajectory that gives rise to a developed discipline of cultural semiotics.) Lotman's formulation and explication of semiospheric space is the single most powerful contributing factor to his

success in presenting a usable metalanguage for cultural analysis. Vyacheslav Ivanov, Lotman's colleague and co-founder of the Tartu-Moscow School, is very emphatic in his refocusing of the semiotic agenda so that it is contextualized within the defining principles and mechanisms of the semiosphere itself (Ivanov 1998: 792).

Lotman's requirement of multiple languages as "the minimal meaning-generating unit" may be interpreted in a variety of ways and on a variety of levels (Lotman 1992a: 16). For instance, these different languages could be the languages of the internal spaces of the semiosphere and the surrounding spaces in which the semiosphere is situated or could include Lotman's fundamental distinction between I-I (also called *autocommunication*) and I-s/he models of communication as presented in *Universe of the Mind* (Lotman 1990: 21–33). The primary function of autocommunication is to create new information at both the cultural and individual levels. This new information displays an important series of characteristics, including (1) its qualitative reconstruction; (2) its not being self-contained or redundant; and (3) the doubling and redefinition of both the *message* and the *code* (Lotman 1990: 21–22). I will return to this question when contrasting Lotman with Vygotsky's work below.

An interesting corollary of Lotman's requirement of a minimum of two languages is that all phenomena must be translated in order to be perceived in semiospheric space. Such a formulation brings Lotman close to the non-structuralist semiotic theory of C. S. Peirce. Furthermore, all translations necessarily change meaning, and the act of non-comprehension is as salient as the act of comprehension.

The relationship between translatability and nontranslatability in Lotmanian theory is an important source of *tension,* which is a basic structural principle of all semiotic space that plays an integral part in the realization of discontinuities in the dynamic form of *explosions.* In the introductory chapter of *Culture and Explosion,* Lotman describes the interrelationship of the multiple languages that lie at the heart of semiotic space and their mutual untranslatability (or limited translatability) as the "source of adjustment of the extra-lingual object to its reflection in the world of languages" (Lotman 1992a: 10). Lotman expands this description in his definition of semiotic space:

> *Семиотическое пространство предстает перед нами как многослойное пересечение различных текстов, вместе складывающихся в определенный пласт, со сложными внутренними соотношениями, разной степенью переводимости и пространствами непереводимости.* (Lotman 1992a: 42)

> Semiotic space appears before us as the multi-layered intersection of various texts, which are woven together in a specific layer characterized by complex internal relationships and variable degrees of translatability and spaces of untranslatability. (Lotman 2009: 23)

In concluding this section, I would like to mention Lotman's contribution to understanding the function of collective memory:

> *[...] культура представляет собой коллективный интеллект и коллективную память, т.е. надындивидуальный механизм хранения и передачи некоторых сообщений (текстов) и выработки новых [...]. Память культуры не только едина, но и внутренне разнообразна. Это означает, что ее единство существует лишь на некотором уровне и подразумевает наличие частных «диалектов памяти», соответствующих внутренней организации коллективов, составляющих мир данной культуры.* (Lotman 1992b: 200)

> […] culture is both collective intellect and collective memory, i.e. a *supra-individual* mechanism of preservation and the conveyance of specific texts and the generation of new ones […]. Cultural memory is not only unified, but also has internal heterogeneity. This means that its unity exists only at a specific level, and presupposes the existence of discrete dialects of memory that correspond to the internal organization of collectives that constitute the world of a particular culture […]. (My translation, E. A.)

Collective memory is a mechanism for self-preservation and cultural propagation. Lotman's perspective on the importance of oral and written culture texts as the basis for collective memory is central to explaining the role of language in this process. In shifting the burden of memory from the individual to an externalized symbolic system collectively maintained through the process of writing, we are able to more clearly see how oral texts place a greater load on the individual's memory system (Lotman 1990: 246–247). Thus, language becomes the symbolic condenser of the different levels of semiosis and different temporal segments (Lotman 1990: 110). Lotman combines the forces of collective memory and collective intellect to contruct a model of culture in which knowledge is maintained and transferred through time, and the actualization of codified and innovative information are guaranteed (Lotman 1992b: 200; Andrews 2003: 157).

Continuity and discontinuity in dynamic change

Lotman is one of several semiotic theoreticians who have made significant contributions to the understanding and application of continuous and discontinuous phenomena. His work is closer to a Thomian model (cf. Thom's work on morphogenesis) than to a Peircean one, and focuses on the primacy of discontinuity as the beginning of all perception (Lotman 1992a: 17–25; Thom 1975: 7; Peirce 1957: 59, 204). However, while Lotman begins with discontinuity, he points out how these "small portions of irritations" are reinterpreted by the organism as continuous and gradual, and also describes the

importance of both discontinuity and continuity as sources for cultural dynamics and evolution (Lotman 1992a: 17, 26–7). Furthermore, Lotman points out that the constant interaction of discontinuous and continuous phenomena leads to the impression that they are something other than themselves. Lotman calls this the "appropriation of misleading self-definitions" (from the neologism '*самоназвание*', which literally means '*self-naming*') (Lotman 1992a: 26) and explicitly describes a two-tiered process whereby the self-naming occurs before the cultural metalanguage imposes its own name. Thus, the misappropriation occurs on at least two distinct levels, which creates additional difficulties in unravelling the source of cultural shifts.

What is most important about this distinction for Lotman is the intertwined reactivity of continuous and discrete dynamic forces, such that the strength of change in one area evokes an equally powerful change in another, distinct area. The more aggressive the realization of continuous processes, the stronger the reaction in the realization of discrete processes. In fact, for Lotman the "crossing over" between semiotic categories of diverse structural organization is the primary source of dynamic change in any system (Lotman 1992a: 26–27).

Lotman provides a finer grade of distinction to include *actual discontinuity* and the *perception of discontinuity.* The perception of discontinuity is manifested in the context of a culture's power of self-description. Even though a culture's development is cyclical in nature according to Lotman, the periods of self-awareness are "usually recorded as intermissions" (Lotman 1990: 144). The result is the production of a cultural text that is viewed as a "freeze frame, an artificially frozen moment between the past and the future" (Lotman 1992a: 27). The asymmetrical relationship between past and future is fragmented into a bifurcated past made of direct textual memory and correlative extratextual memory that come together like the point of a cone in the present and break apart again in the future into a spectrum of equally viable but widely variegated possibilities. It is at this juncture that we confront the question of textual memory, which requires both individual and collective memory systems, which are guaranteed outcomes within cultural space.

If language itself necessarily exists within and beyond the individual speaker, and requires both individual and collective memory, then texts, as codifications of moments between past and future in an asymmetrical fashion, become meaningful in the *undeterminedness* of the future (Lotman 1992a: 27–28). And culture, in Lotman's definition, necessarily includes not only collective memory, which allows for the preservation and transfer of knowledge and information through time, but collective intellect, which guarantees the potential actualization of coded information in the present and the production of new information in the future (Lotman 1992b: 200). Thus, it is through the communication act, defined as a semiotic entity, that continuity and higher-level ordered (rule-based) systems such as language and culture are created

from endless strings of discontinuities: "The individual human intellect does not have a monopoly in the work of thinking. Semiotic systems, both separately and together as the integrated unity of the semiosphere, both synchronically and in all the depths of historical memory, carry out intellectual operations, preserve, and work to increase the store of information. Thought is within us, but we are within thought just as language is something engendered by our minds and directly dependent on the mechanisms of the brain, and we are with language" (Lotman 1990: 273).

Autocommunication

Lotman's requirement of multiple languages as "the minimal meaning-generating unit" may be interpreted in a variety of ways and on a variety of levels (Lotman 1992a: 16). For instance, these different languages could be the languages of the internal spaces of the semiosphere and the surrounding spaces in which the semiosphere is situated, or they could include Lotman's fundamental distinction between I–I (also called *autocommunication* [*автокоммуникация*]) and I–s/he models of communication (Lotman 1990: 21–33; 2000: 163–177). The concept of autocommunication is one of Lotman's most powerful for defining mechanisms for the generation of meaning within semiotic (read *cultural*) space. The primary function of autocommunication is to create new information at both the cultural and individual levels. This new information displays an important series of characteristics, including (1) its qualitative reconstruction, (2) its not being self-contained or redundant, and (3) the doubling and redefinition of both the *message* and the *code* (Lotman 1990: 21–22; 2000: 163–165). Autocommunication as one of the primary modes of communication is most often *unarticulated* and *nonconscious* within the community of users. In contrast, in I–s/he communication the message and the code are more stable, along with the amount of information conveyed, while the speakers/hearers are variable and in flux. Both modes of communication are present in all cultures, but the degree to which they are utilized varies not only from culture to culture, but also within internally bounded cultural spaces.

One of the more salient features of autocommunication is that the sign types involved are more *indexicalized* (e.g., abbreviations can be deciphered only by the text creator, complete sentences are lacking) (Lotman 1990: 26–27). Lotman also claims that rhythmical-metrical systems originate in the autocommunication system and not in the I-s/he system (Lotman 1990: 30). Thus, cultural space is not merely "the sum of the messages circulated by various addressers," but is also defined through autocommunication – "one message transmitted by the collective 'I' of humanity to itself" (Lotman 1990: 33).

What is most important is the obligatory *doubling* of parts of the speech act required by autocommunication. Using Jakobson's speech act model, which is at the basis of Lotman's model, we can say that all of the six factors of the speech act (addresser, addressee, code, contact, context, message) are *doubled* in any given single communication act. For both Jakobson and Lotman, there is also never a single speech act, but they necessarily occur as plurals/multiplicities in a potentially infinite series.

What is important to know about speech acts?

The Jakobsonian speech act model (1987[1957]: 66–71) is a critical baseline upon which Lotman constructs his model and serves as an ecologically-valid minimal unit of human language. This dynamic model is a heuristic for understanding the minimum (not maximum) factors and functions present in any linguistic speech act:

Six Factors:		***Six Functions:***	
Context		Referential	
Contact		Phatic	
Addresser	Addressee	Emotive	Conative
Code		Metalingual	
Message		Poetic	

Figure 1. Jakobson's speech act model.

For Jakobson and Lotman, it is important to understand that all speech acts are multi-faceted events embedded in the cultural context where the resulting *meanings* of acts are always *negotiated* (they are never given as *a priori* categories) (cf. "It's cool" – meaning (1) the weather is chilly; (2) there is no problem, everything is fine; (3) something is interesting, neat, etc.). This model is compatible with imagining the neural image of a word as multisensory and obligatorily involves cross-modal effects (cf. Marslen-Wilson 2007; Watkins *et al.* 2003; Massaro, Cohen 1995; McGurk, MacDonald 1976; Lieberman 2006). By suggesting that word meanings are multisensory, I am implying an approach that is deeply informed by cognitive neuroscience, particularly the work of Mahon and Caramazza 2008, as well as certain synergies with the "embodied" approach given in Gallese and Lakoff 2005.

Another result of modelling speech acts in this manner is highlighting the importance of who is talking and who is listening. Speakers and hearers are always members of multiple and changing *speech communities* and *communities of practice*. This means that we must imagine speech acts not only at an individual level of production and perception, but also at the group level. All speech acts (and all language) are

ambiguous and *redundant* to varying degrees. Finally, human language is not the product of a single brain but rather a product of multiple brains in sync with each other and embedded in the cultural context.

Signification and memory

> Individual our memories may be, but they are structured, their very brain mechanisms affected, by the collective, social nature of the way we as humans live. (Steven Rose 1992: 60)

Merlin Donald (2004: 43) identifies the key to understanding human language as a collective phenomenon when he notes that: "[t]he isolated brain does not come up with external symbols. Human brains collectively invent symbols in a creative and dynamic process". Symbols are invented, according to Donald (2004: 43), by means of executive skills "that created a nervous system that invented representation out of necessity". It is the human ability to collectively invent innovative and dynamic external symbols that the field of linguistics calls *signification*. Without signification as the initial and primary ability that underlies human language and all of human cognition, there can be no nonhereditary collective memory. Signification always requires the translation from one system into another, and the process is potentially infinite and unbounded (Jakobson 1985: 206; CP 4.127). This fact will become especially relevant in understanding speech acts and the construction of linguistic meaning.

Donald singles out *autocueing*, the uniquely human ability to voluntarily control memory recall, that provides freedom from the *hic et nunc*. It would have been a prerequisite to the development of human language, which requires volitional actions, including retrieval of linguistic forms and their modification (Donald 2004: 45). Also, the many different living systems are able to communicate with other living beings within and beyond their species and the environment, but signification and autocueing are the critical pieces for human language. With these two primary abilities – signification/invention of creative and dynamic external symbols and voluntary control of memory retrieval – the evolution of human language becomes possible.

Tomasello's (1999: 97) insights about linguistic reference as a "social action" is an important corollary to the phenomenon of signification. At the point at which children begin participating in the signification process as learners of linguistic symbols, they can tap into not only the richness of "preexisting" knowledge, but also participate in the uniqueness of linguistic symbols and their inherent polysemic nature, where one can cognitively embrace an event or object at multiple levels simultaneously (cf. "a rose, a flower, and a gift") (Tomasello 1999: 107).

Lotman, Vygotsky, and cognitive models of signification and communication

We have seen that Lotman presents a contextually based theory of cultural meaning that relies heavily on semiotic principles. In particular, Lotman's modelling of communication requires multiple languages and multiple systems of communication acts, including I–s/he and I–I (autocommunication) systems. While the term *autocommunication* may be somewhat misleading, it is, in fact, autocommunication that plays a central role in the generation of new information at both the collective and individual levels. Texts, according to Lotman, may be interpreted (or misinterpreted) as predominantly code or message. When a text fails to convey new information, but converts existing meanings into a new system, that text is being used as code and this is the essence of autocommunication. Thus, central to the notion of autocommunication is the acknowledgment of the preexistence of cultural and linguistic structures that give rise to qualitative reconstructions, new forms, and new meanings.

Clearly, Lotman's autocommunication is not based on Vygotsky's definitions of egocentric or internal speech. Furthermore, Lotman's distinction is not embedded in a developmental model, which is an essential part of Vygotsky's system. However, Lotman's model extends the notion of the primacy of communication events in which language users are members of a collective consciousness not only at the inception of their development, but throughout the life cycle of the individual. Both Lotman and Vygotsky agree on the important generative power of language in moving and modulating meanings between the individual and collective levels, and both of them are interested in understanding how this happens. What they share is their focus on semiotic units and the importance of meaning (not merely information) and the construction of memory, which is an important part of higher thought. When language is viewed as a mediator between the code and the sociocultural context, and specific forms of language (such as egocentric, internal, social) can serve as a basis for what Vygotsky calls *metaconsciousness* (the development of higher thought), then we see more clearly how these two semiotic approaches are complementary to each other. For both Vygotsky and Lotman, metaconsciousness is embedded in the semiospheric context (or social milieu) and only subsequently is it taken up by the individual. As Frawley (1997: 89) eloquently states: "Metaconsciousness is first of all a property of the social group which is then appropriated by the individual, who can in turn relocate metaconsciousness in the group, depending on the task at hand. Higher thought is both double and fluid, flowing from the group to the individual and back again to the group".

What becomes meaningful for the individual, and thus worthy of memory encoding, is a product of both the semiosphere (cultural space) in which the individual exists and the individual's goals at a particular point in time. As Daniel Schacter (1996: 52) points out: "Encoding and remembering are virtually inseparable. But the close

relationship between the two can sometimes cause problems in our everyday lives. We remember only what we have encoded, and what we encode depends on who we are – our past experiences, knowledge, and needs all have a powerful influence on what we retain." Also, the cultural values and languages that we speak clearly play a role in the construction of the cultural and individual self.

Stephen Rose (1992: 321) argues for the necessity of morphological, biochemical and physiological dimensions as minimums to begin to understand memory. Rose (1992: 90) also identifies salient features of memory, including that it is error-full and utilizes multiple modalities, and he therefore notes that his three dimensions may not be sufficient, but moves his experimental paradigm toward a different goal: "[I]n an important sense the memory is not confined to a small set of neurons at all, but has to be understood as a property of the entire brain, even the entire organism. […] The point is that the sites of change are not equivalent to the sites of the property that they change" (Rose 1992: 322).

What is clear is the need for a more robust theory of memory and language that can be not only relevant at the system level but also provide viable system-based explanations. The critical role that language plays in the encoding, maintenance, and retrieval of memory has yet to be fully articulated in cognitive science research. Inclusion of the works of Lotman and Vygotsky into this conversation is a positive step, a way to bridge the gap between idiosyncratic and system-based explanations.

Extending Vygotskian categories

Vygotsky's defining attributes of egocentric speech (illusion of comprehension, collective monologue, and vocalization) and his definition of the relationship of egocentric speech to internal speech, while originally conceived and experimentally validated in young children and child development, may also provide a key to understanding not only child development but also questions of language changes in aging. Specifically, in both normal aging and in some age-related memory pathologies, empirical data may be interpreted to demonstrate a reemergence of egocentric speech, where individuality is consumed in the loss of individual memory and consciousness, and the individual disappears again into the broader cultural context of collective monologues and illusions of comprehension.

The notion that egocentric speech could reemerge in aging is consistent with Vygotsky's characterization of the evolutionary path that egocentric speech takes in early development, as it becomes intertwined with internal speech. Such an application of Vygotsky's framework beyond early child development provides additional theoretical premises for analysing language change throughout the life cycle. Application of Lotman's communication model (I–s/he and I–I) and Vygotsky's modelling of speech

types and his work on the relationship between thinking and speech can provide a useful metalanguage for understanding and analysing language change and loss in aging. Future research in examining the interaction of language and aging, including empirically rich data obtained through appropriate experimental methods, will be required in order to demonstrate the ultimate utility of Vygotskian modelling of speech types.

Future directions in semiotics and the cognitive sciences

There are currently several trends in the cognitive sciences that are working toward a theory of understanding the language for thought and memory. Frawley's work puts forward a set of research that explores the relationship between private (egocentric) speech and the language for thought. His observation about the appropriate way to define the relationship between private speech and thought also provides a realistic appraisal of how to understand the experimental data: "Private speech does not represent thought but is a *symptom* of it, and so, with respect to performance, reflects both failure and success" (Frawley 1997: 185).

One of the challenges in moving forward in cognitive research involving language and memory may be the redefining of basic concepts in the related fields. Donald has argued for recognition of "the immediate time frame within which most conscious human action takes place. . . . [and which] is a much larger window of experience than short-term memory" (2001: 47). Donald makes the point that many laboratory protocols have a short time frame by design and often do not take into account this more critical, longer time frame (Donald 2001: 47).

The work that I and my colleagues undertook with H. M. (Skotko *et al.* 2005) is an example of how changing the time frame of analysis can produce results that both challenge and deepen our understanding of different types of memory and lead to a fine-tuning and strengthening of models of human memory (cf. Dew, Cabeza 2011). When looking at H. M.'s usage of language from a more broadly based discourse perspective, it becomes clear (1) where H. M. demonstrated higher competency than his peer group (in type/token ratio) and (2) where he demonstrates deficits (Skotko *et al.* 2005: 403). If we now implement Jakobson's speech act model as discussed previously, we can characterize H. M.'s speech in terms of the six functions (metalingual, conative, poetic, emotive, referential, phatic) in the following manner: (1) H. M.'s *metalingual* function is highly developed and exceeds expectations for healthy subjects of his educational background and age group; (2) H. M.'s *conative* responses, whether they be verbal answers to questions or subsequent actions responding to requests, are robust; (3) H. M.'s use of the *poetic* function is developed, especially in punning and humorous turns of phrase, and merits special attention; (4) H. M.'s *emotive* function is appropriate in terms

of his affect, sense of humour, laughter, eye contact with interlocutors, body language, gestures accompanying speech, but his desire to share verbally is more reactive than initiatory; (5) H. M. makes limited reference to the extralinguistic context surrounding his discourse, but on occasion does make direct references to persons and things; thus, his *referential* function is operative; (6) The weakest area of discourse for H. M. in terms of the speech act model is his lack of use of the *phatic* function, including his reluctance to initiate or continue conversation, to reinitiate a previously given topic of conversation, or to interact with his interlocutor's narrative if a question to him is not involved. (Note that there are exceptions to this characterization, but they are quite infrequent.)

Vygotsky's framework for the interrelatedness of different types of speech may also lead to interesting results in the context of analysing so-called critical periods [(also called periods of "susceptibility" or "sensitivity" (Dowling 2004: 51)] in language acquisition. The notion that there is a critical period for language acquisition is still popular in many linguistic circles and remains for many unanalysed and unchallenged. However, as we have seen, for the neuroscience community the notion of critical periods is much more complicated than the primitive rendition we often see through the prism of linguistics. Vygotskian theory may facilitate a rethinking of this notion within the field of linguistics and lead to more realistic conceptualizations, thus bringing the fields of linguistics and neuroscience into closer relationship.

Both Lotman and Vygotsky have generated modelling systems that contribute to a theory of the generation, maintenance, and loss of meaning at all levels of human interaction. Their work is a constant reminder that what becomes meaningful for the individual, and thus potentially worthy of memory encoding, is a product of the collective semiotic space in which human beings exist and develop throughout their lives.

Improving imaging methods for examining language acquisition, maintenance and loss

In our unique longitudinal fMRI study of second language acquisition (Andrews *et al.* 2013; Andrews 2014), we set out to collect a robust set of data acquired longitudinally using both fMRI and behavioural and proficiency data on subjects who begin their intensive study of a second language (Russian) during the study. By coordinating proficiency testing and fMRI scanning, we could analyse the degree to which fMRI can track language acquisition within subjects. From the behavioural and proficiency data we could derive empirically valid information about the achievements of the subjects in a range of measurements that are available by task (listening comprehension, reading, grammar/lexicon) as a component of the analysis of the fMRI scan data for a listening comprehension task. Regions of interest (ROIs) in our fMRI study were

selected based on the following principles: (1) regions that are frequently mentioned in the fMRI literature for sentence comprehension (Price 2010: 68) or CSM literature (Corina *et al.* 2010: 107–111) and (2) regions that showed significant change across the language acquisition scans. The regions (bilaterally given) are MTG (medial temporal gyrus), STG (superior temporal gyrus), MFG (middle frontal gyrus), IFG (inferior frontal gyrus), PoG (postcentral gyrus), PrG (precentral gyrus).

Using a multivariate analysis of covariance allows us to determine if there is a significant relationship between the changes in activations in the ROIs for each subject across the 3 scans/time points by comparing those activation changes to changes in proficiency for each subject. The result produced a p value = 0.01, which supports the fundamental research hypothesis that language acquisition is associated with characteristic activations found in the Russian conditions. Furthermore, the lack of significance for the English-rest condition (where $p = 0.47$) strongly supports the belief that non-normal residuals are not distorting the analysis in any important way. Finally, time effect is significant for the Russian conditions and shows activation levels changing across the three sets of longitudinal measurements.

The importance of understanding *invariance in variation* has been one of the central concerns of theoretical linguistics of the 20th and 21st centuries. The construction and conducting of imaging studies that include protocols of language that are not only ecologically valid and coupled with behavioural and proficiency data, but also allow for multiple comparisons across and within subjects longitudinally, may provide a new perspective on how to answer some of the most challenging issues about brain and language, as well as formulate new questions that can deepen the research paradigms in cognitive and neurolinguistics.

Moving forward in the study of brain(s) and language(s)

The key to understanding human language as a collective phenomenon is, as Donald (2004: 43) notes, that "[t]he isolated brain does not come up with external symbols. Human brains collectively invent symbols in a creative and dynamic process", and symbols are invented by means of executive skills "that created a nervous system that invented representation out of necessity". It is the human ability to collectively invent innovative and dynamic external symbols that the field of linguistics calls *signification*. Without signification as the initial and primary ability that underlies human language and all of human cognition, there can be no nonhereditary collective memory. Signification always requires the translation from one system into another, and the process is potentially infinite and unbounded (Jakobson 1985: 206; CP 4.127). Signification is a prerequisite for human language and nonhereditary collective memory; it is not a prerequisite for all forms of communication.

If we extend Lotman's and Donald's point about writing and collective memory to contemporary language users, we are reminded that writing is symbiotic with reading, and that in fact reading is one of the important components of not only deepening lexical, grammatical and syntactic knowledge of language(s), but it is also a fundamental component in education and the learning of other types of knowledge ranging from the natural and physical sciences to the social sciences and humanities. Once we become readers, the neurological interface of our *languaging* is fundamentally different than it was when we were unable to read. When the auditory and visual pathways learn to interact in reading, and this interaction becomes ubiquitous, then these different modalities continue to interact even when we are not reading.

As we begin to move our research perspective from a language to multiple languages and how they are acquired, maintained and lost throughout the life cycle, we are challenged to frame our work in methods that treat *change as essential,* not essentialist. This requires a more dynamic framework for analysis, and also requires the inclusion of a broader range of subjects and studies from the lesion-deficit tradition as well as healthy subject research. Lotman's *oeuvre* provides additional avenues for explicating how multimodality and variation are relevant to the interface of the functioning brain and human language.

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